COMMENTS ON THE DRAFT SECOND REPORT TO CONGRESS (RTC II): "SOLID WASTES FROM PROCESSING OF SELECTED ORES AND MINERALS"

Submitted by

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I. INTRODUCTION AND SUMMARY

Background

Under contract to the United States Environmental Protection Agency (EPA), ICF Incorporated (hereinafter ICF) has prepared a draft Report to Congress on Solid Waste From Processing of Selected Ores and Minerals[1] (hereinafter draft RTC). This document was written to satisfy, in part, the requirements of Section 8002(p) of the Resource Conservation and Recovery Act (RCRA) to conduct a,

> . . . "detailed and comprehensive study on the adverse effects on human health and the environment, if any, of the disposal and utilization of solid wastes from the extraction, beneficiation, and processing of ores and minerals . . . . Such study shall be conducted in conjunction with the study of mining wastes required by subsection (f) of RCRA . . . ."

This study, together with analysis of public comments and other pertinent inputs, will be considered by the EPA Administrator in deciding how best to regulate solid wastes from processing of ores and minerals.

Kennecott Utah Copper has obtained a copy of ICF's 14 December 1987 draft RTC and is submitting these comments for EPA's consideration in preparing the final RTC. Kennecott Utah Copper operates one of the world's largest integrated copper mining and processing facilities. Kennecott's operations could be significantly affected by EPA's regulatory determination on mine and processing wastes, so we have a substantial interest in a wise resolution of these matters. Throughout EPA's study of mining and minerals processing wastes, Kennecott Utah Copper has provided substantive and detailed material for EPA's review. Although EPA has not solicited comments on this draft RTC from industry at this time, we are very concerned that this report is incomplete, factually in error, and ultimately does not present a balanced or factually

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[1] ICF, Incorporated, "Report to Congress on Solid Waste From Processing of Selected Ores and Minerals," Work Assignment #12, EPA Contract #68-01-7259, 20 October 1987, revised 14 December 1987.

accurate foundation for decision making. These concerns prompted the preparation of this submittal.

Summary

On balance, our assessment is that the ICF draft RTC is seriously flawed. Nonetheless, the draft RTC is not entirely without merit. Useful findings of the draft RTC are discussed in Section II of these comments, and include:

- -- a generally accurate description of the mining waste exclusion,
- -- a recognition of many (but not all) of the key site-specific factors (e.g., differences in processes, materials management techniques, waste characteristics, "environmental" variables) that act to render each primary metal facility unique to a degree, and
- -- an appropriate reclassification of some secondary materials, earlier termed wastes by EPA, as legitimate process materials.

However, in most other respects the draft RTC is inadequate, misleading, incomplete, or otherwise in error. Kennecott Utah Copper's concerns are detailed in Section III of these comments and enclosed attachments. These concerns include:

- -- a failure to recognize the unique characteristics of integrated facilities -- at least with respect to a Subtitle C or "C-" regulatory framework, a serious shortcoming at variance with EPA's mining waste study plan,
- -- an incorrect classification of many secondary materials (e.g., anode slags, converter slags, and refinery slimes in the case of copper production) as wastes rather than process flow streams -- which not only leads to an overestimate of waste quantities, but also incorrectly subjects process streams to regulation as wastes,
- -- a failure to consider accurate site-specific data submitted to EPA by firms in the copper, lead, and zinc industries,
- -- the inclusion of closed or secondary smelters/refineries in the data base of primary facilities, thus distorting the statistics presented in the draft RTC,
- -- a consideration of too few regulatory options for study and, more important, failure to evaluate a Subtitle D+ regulatory alternative, viewed by many as the most logical regulatory choice,
- -- an inadequate and misleading discussion of the present suite of environmental regulations which distorts the evaluation of the Subtitle D regulatory scenario,

-- the incorporation of unwarranted assumptions of regulatory flexibility in the Subtitle C- scenario which renders the resulting cost analysis highly speculative and biased,

-- the omission of explicit discussion of many key regulatory issues, such as the "derived from" and "mixture" rules, which could dramatically affect regulatory cost impacts and, indeed, affect the feasibility of the Subtitle C- regulatory scenario,

-- a reliance on an extremely limited data base consisting of EP toxicity test results for determining the potentially hazardous nature of processing wastes -- an action justified neither on statistical nor scientific grounds,

-- the use of case studies for damage assessment that are inappropriate for inclusion because they are not representative of current practice or do not involve processing activities or both,

-- the preparation of just a cost analysis rather than a full economic analysis of regulatory impacts, thus omitting analysis of key effects of regulation, such as competitiveness and balance of trade shifts, changes in domestic self-sufficiency, facilities closures, layoffs, etc., -- all germane to EPA's regulatory decision, and

-- the presentation of an analysis of potential danger that is so "conservative" in its assumptions as to be virtually meaningless.

Overall, the report needs to synthesize the data presented to aid those who will be making decisions on regulatory alternatives. Conclusions regarding the extensive recycling of mineral processing materials and the limited damages from mineral processing wastes should be included.

The enclosed comments amplify the above. These comments are substantive, detailed and, it is hoped, ultimately constructive. Unfortunately, the draft RTC will require major and extensive revisions in order to provide a useful foundation for EPA's regulatory determination.

Notwithstanding our disappointment with the ICF draft RTC, Kennecott Utah Copper intends to continue to work with EPA to develop a responsible regulatory framework for mining and processing wastes.

II. USEFUL FINDINGS OF THE DRAFT RTC

Introduction

As noted in the introduction, the draft RTC draws several useful points/conclusions. Kennecott Utah Copper's comments and additional suggestions with respect to these points are offered in this section.

Defining the Mining Waste Exclusion

In general, Kennecott Utah Copper supports the definition of the mining waste exclusion that appears in Chapter II of the draft RTC. Kennecott Utah Copper submitted extensive comments on "Bevill Boundaries" issues raised in the Mining Waste Management Plan released by EPA last June.[1] Those comments will not be repeated here, but we believe that they support the position taken in the draft RTC and we refer EPA to them as a detailed statement of Kennecott Utah Copper's position. In addition, we offer the following comments on specific aspects of the definition provided in the draft RTC.

— Uniquely Associated Wastes

Kennecott Utah Copper supports EPA's original interpretation of the exclusion to cover all wastes "uniquely associated with . . . mining and allied processing operations."[2] However, the RTC should make it clear that this criterion is satisfied by any waste produced by a process that is essential to smelting and refining operations. The RTC should also include a list of any processing wastes that do not meet this requirement in the agency's view, in addition to the three wastes mentioned in the draft.

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[1]See Comments of Kennecott on Bevill Boundaries Issues, August 21, 1987.

[2]See 45 Fed. Reg. 76619 (November 19, 1980).

— Direct Line Operations

Kennecott Utah Copper opposes the draft RTC's limitation of the Bevill exclusion to wastes produced by processes "in a direct line from ores and minerals to final refined product" (p. 2-6). However, the draft RTC provides only one example of such a waste. As noted in the draft RTC, some processes not in a direct line "produce products necessary or critical to the ore/mineral refining operation" (id.). Further, at integrated mineral mining and processing facilities wastes from "indirect" processes are likely to be mixed with wastes from "direct line" processes. If "indirect" process wastes must be segregated and managed under existing Subtitle C regulations, substantial and unnecessary disruption of existing waste management practices may result. At the very least, the Bevill exclusion should be extended to cover wastes from on-site "indirect" processes where they are co-managed with wastes from direct line processes.

— Final Point of Refinement

Kennecott Utah Copper agrees with the finding in the draft RTC that mineral processing wastes are covered by the Bevill exclusion "up to the point at which no further refining is required to produce a commercial product" (p. 2-7). As noted in prior Kennecott Utah Copper comments, although anode copper produced by Kennecott Utah Copper's smelter is 99.6% pure, it must be further refined before it can be fabricated into commercial products.[3] Accordingly, smelter and refinery wastes that meet the other aspects of EPA's definition should be covered by the Bevill exclusion. This is consistent with EPA's original interpretation of the exclusion "to include solid waste

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[3]See Kennecott Utah Copper, EPA Mine Waste Regulatory Development: Work Group Tour, August 26, 1987. This booklet was distributed to EPA staff who toured Kennecott's facilities on August 26, and was also submitted with Kennecott's comments on EPA's Mining Waste Management Plan, September 3, 1987.

from the exploration, mining, milling, smelting, and refining of ores and minerals."[4] It is also consistent with the terms of the exclusion, which covers all ore and mineral "processing" wastes.[5] Within the mining industry, the generally accepted meaning of "processing" includes smelting and refining operations.[6] As explained in Section II of these comments, removal of any smelter or refinery wastes from the Bevill exclusion would cause severe and unnecessary regulatory consequences for Kennecott Utah Copper's integrated copper mining, milling, smelting, and refining waste handling system.

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[4]See 45 Fed. Reg. 76619 (November 19, 1980). Also, EPA would bear a heavy burden to justify any departure from this contemporaneous and longstanding interpretation of the Bevill exclusion. See, e.g., Motor Vehicle Manufacturers Association v. State Farm Mutual Life Insurance Company, 463 U.S. 29, 42 (1983).

[5]The legislative history of the Bevill exclusion clarifies that it was intended to "be read broadly, to incorporate the waste products generated in the real world . . . . The inclusion of all such wastes within the scope of the amendment assures that the health and environmental effects of all wastes generated by the listed operations are fully studied in the detailed and comprehensive manner required." 126 Cong. Rec. E4957 (daily edition, November 17, 1980). When EPA proposed to narrow the exclusion in 1985, Rep. Bevill and former Rep. Santini confirmed this original intent in testimony opposing EPA's proposal. See Statement of the Honorable Tom Bevill on RCRA Mine Waste Exclusion, November 14, 1985; Statement of Jim Santini on RCRA Mining Waste Exclusion, November 14, 1985.

[6]"Processing" is defined by the Bureau of Mines as "the methods employed to clean, process and prepare coal and metallic ores into the final marketable product," (Mining, Minerals and Related Terms, 1968 ed.). The Department of Interior refers to the "mineral processing industries" as including smelting and refining (Mining and Minerals Policy, 1975, p. 6). The Engineering and Mining Journal includes smelting and refining under "mineral processing operations" (International Directory of Mining and Mineral Processing Operations, 1980 ed.). The Society of Mining Engineers covers smelting and refining in its discussion of "mineral processing" (Mining Engineering Handbook, 1976 ed.). Even EPA's contractors have characterized smelting and refining as "processing." See PEI Associates, Overview of Solid Waste, General Management and Chemical Characteristics for the Primary Smelting and Refining Industries, pp. 3-4, 6-1, December 1984; ICF, Inc., Hazardous Waste Management Costs in Selected Primary Smelting and Refining Industries, p. 4-1, September 1985. The Supreme Court has held that when such technical terms are used in a statute, they are presumed to have their technical meaning. See Corning Glass Works v. Brennan, 417 U.S. 188, 201-02 (1974).

-- Fifty Percent Rule

Kennecott Utah Copper does not oppose the draft RTC's "fifty-percent rule" for distinguishing between primary and secondary operations. However, as Kennecott Utah Copper has previously pointed out to EPA, at Kennecott Utah Copper's operations secondary materials may be reprocessed in batches, which may, for brief periods of time, exceed 50 percent of the smelter feed.[7] The RTC should clarify that this rule will be applied on an average rather than instantaneous basis (e.g., monthly) and will not be construed as a prohibition on short-term smelter charges containing over 50 percent secondary materials.

-- Processing of Intermediate Materials

Kennecott Utah Copper supports the draft RTC's recognition that reprocessed secondary materials are not "wastes" for federal regulatory purposes.[8] However, Kennecott Utah Copper does not agree with the draft RTC's assertion that wastes resulting from reprocessing of Bevill wastes are not covered by the exclusion because Bevill wastes "are not in any direct form an ore or mineral," (p. 2-8). Webster's New Collegiate Dictionary, p. 725, 1975 ed., defines "mineral" to include "a synthetic substance having the chemical composition and crystalline form and properties of a naturally occurring mineral." The definition of "ore" includes "1: a mineral containing a valuable constituent (such as metal) for which it is mined and worked; 2: a source from which valuable matter is extracted," (p. 801). Some Bevill wastes, such as concentrator tailings and various slags, clearly can be "ores or minerals" under these definitions. For example,

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[7] See letter from Gregory H. Boyce to Ben Haynes, p. 21, July 31, 1987.

[8] See AMC v. EPA, 824 F.2d 1177 (D.C. Cir. 1987).

slag produced by the Noranda process used at Kennecott Utah Copper's Utah smelter averages approximately 7% copper -- 13.5 times as rich as the natural copper ore itself. In the mining industry, today's waste is tomorrow's ore, and this will be true as long as continuing technological developments permit extraction of valuable metals from increasingly lower grade materials. The rules for applying the Bevill exclusion should be revised to reflect this fact in the final RTC.

Recognition of Some Important Site-Specific Factors

The draft RTC is correct in recognizing that there are important site-specific differences among the domestic primary copper smelters and refineries. Relevant factors identified in the draft RTC include:

-- site-specific flow sheets determine whether or not a material is a waste (p. 3-6, 3-8, 3-23),

-- differences in material generation rates (p. 3-8, 3-25),

-- differences in waste characteristics (p. 3-9),

-- varying state requirements (pp. 4-28, et seq.),

-- differences in methods of disposal (pp. 5-8, et seq.),

-- other site-specific differences, e.g.,

- depth to ground water (pp. 5-13, et seq.),
- net recharge,
- proximity to surface water,
- proximity to population,
- proximity to public drinking water supplies.

Recognition of the role/importance of these factors is central to the development of a rational regulatory scheme.

Given that ICF acknowledges the importance of these factors, it is somewhat surprising that ICF emphasized relatively inflexible regulatory options, a point discussed at length in the next section. It is also surprising that, having recognized numerous site-specific differences, ICF used simplistic and inflexible rules for waste characterization. For example, the draft RTC states (p. 3-15),

> "Any waste type indicated by the data to exhibit one or more hazardous characteristics at one or more plants was assumed to be potentially hazardous at all plants generating that waste."

The reason given (footnote p. 3-15) is to protect confidentiality, but this conservative and inflexible decision rule ignores potentially important differences in waste characteristics among the various facilities. For example, slag from smelting is considered to be a hazardous waste at <u>all</u> facilities simply because 2 samples of 11 (p. 3-30) exceeded EP toxicity limits. The analyses given in Exhibit 3-8 of the draft RTC do not indicate the origin of the samples, so Kennecott Utah Copper cannot challenge the analytical results directly. However, it is Kennecott Utah Copper's experience that smelter slags do not fail EP toxicity tests. Thus, these test results may be in error. In any event, a "data base" of 11 samples from 5 facilities can hardly constitute a firm evidential basis for claiming that all slags from all facilities would be hazardous! Differences in the mineralization of the ore body and smelting technology employed (e.g., reverberatory vs. flash smelting) -- both key variables omitted in ICF's list of site-specific factors -- affect the chemical and physical properties of the slag. These in turn influence how these slags are managed -- the metal-rich slags that may have failed the EP test are likely to be those that are recycled, and thus neither are wastes nor pose any hazard. Thus, even if the EP toxicity test results are assumed to be valid (see next section) for the facilities sampled, there is no reason to believe that all slags are hazardous. Similar objections can be raised for many of the other materials studied by EPA.

In the end, the total number of primary copper production facilities is quite small, and the facility-to-facility variation is so large, that a site-by-site analysis is both feasible and necessary.

Appropriate Reclassification of Certain Secondary Materials

In earlier reports, EPA identified 15 materials as wastes (or potential wastes) at domestic copper smelters and refineries. Kennecott Utah Copper submitted extensive comments on this classification scheme, pointing out that nearly all of these were "process streams" and not wastes -- at least as managed at the integrated Kennecott Utah Copper facility. In the draft RTC, three of these -- metal sweepings, spent catalyst, and cathode wastes -- are apparently reclassified as process streams. Kennecott Utah Copper agrees with this reclassification, but urges EPA to reconsider the classification of many of the remaining "wastes," a point discussed in Section III of these comments.

III. KENNECOTT UTAH COPPER'S CONCERNS

Introduction

As noted in Section II, Kennecott Utah Copper believes that the draft RTC contains some useful data and reaches some correct conclusions. But, the draft RTC is flawed in several essential respects. This section details some of the more important errors and omissions.

Failure to Recognize The Unique Characteristics of Integrated Facilities

The term "integrated facility" is used to describe a mining and processing facility where most or all of the key stages (mining-milling-smelting-refining) in primary copper production are either co-located or located within a relatively short distance. Table I presents a list of domestic primary copper-producing facilities that would qualify as integrated or partially integrated facilities. In total, these account for the majority (nearly 77% of domestic primary smelting capacity) of domestic copper production capacity.

The significance of an integrated facility in a RCRA context is two-fold.

- First, co-location of facilities offers additional opportunities for recycle and efficient waste management. The relatively short distances involved lower or eliminate transportation costs that would adversely affect the economics of recycle or treatment of materials. Thus, it is both more economically advantageous and technically feasible to recycle certain materials. Acid plant blowdown (APB), for example, is an acidic by-product of operation of sulfuric acid plants for control of sulfur dioxide (SO_2) emissions at smelters. APB could be used in leaching operations if the smelter were located near to the leach dumps, or it could be mixed with the alkaline tailings -- thus neutralizing the APB -- if the tailings pond were located nearby.[1] These examples serve to indicate some of the benefits of integrated facilities with respect to waste management.[2]

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[1]For various reasons, Kennecott treats the blowdown in a waste water treatment plant (WWTP) at its Utah facility prior to routing the contained water to the tailings pond for recycle. But some other facilities operate as described.

[2]Other examples are legion. Certain refinery materials are advantageously recycled to the smelting furnace or the converters at facilities with co-located smelters and refineries. The economics of recycle would be different at a "stand-alone" refinery.

TABLE I.
INTEGRATED AND PARTIALLY INTEGRATED
DOMESTIC PRIMARY COPPER PRODUCTION FACILITIES

Description	Company	Location	Mine	Mill	Smelter	Refinery
Fully Integrated Facilities (all stages)	Kennecott Utah Copper	Copperton, Utah	X	X	X	X
	Magma	San Manuel, Arizona	X	X	X	X
	Inspiration	Miami, Arizona	X	X	X	X
Partially Integrated	ASARCO	Ray/ Hayden, Arizona	X	X	X	
	White Pine	White Pine, Michigan			X	X
	Phelps Dodge	Hurley, New Mexico	X	X	X	

- Second, the integrated facility would be very difficult to operate under a "Subtitle C" regulatory program. This is because the "mixture" and "derived from" rules (discussed below) would have the effect of multiplying the number of hazardous waste streams at such a facility because of the co-mingling of materials streams at these facilities. If, to continue the above example, smelting/refining wastes were regulated under Subtitle C and APB were a listed hazardous waste, the practice of mixing APB with alkaline tailings would effectively be banned, because no operator could afford to turn a tailings pond into a hazardous waste management facility. This would be true even if the APB were treated prior to subsequent use. Not only would this entail additional costs, but also an environmentally sound materials management practice would be foreclosed.

Integrated facilities, therefore, present two aspects; (i) they offer the opportunity for increased recycle and improved materials management, but (ii) they are more "vulnerable" in a Subtitle C regulatory framework. The draft RTC is entirely silent on the special opportunities and regulatory implications associated with integrated facilities. This significant omission is curious in view of EPA's identification of integrated facilities as a particular item of interest (Issue 3E, p. 4-51) in the mining waste management plan.

Incorrect Definition of "Wastes" and "Waste Generation Rates"

Kennecott Utah Copper takes issue with many of the data and conclusions presented in Chapter 3 of the draft RTC. Two points are of particular note.

First, Kennecott Utah Copper challenges ICF's use of the term of "wastes" to characterize several of the process materials identified in Chapter 3. The draft RTC (p. 2-8) correctly notes that "Intermediate materials produced during the beneficiation and processing of ores and materials and which are further processed to recover useful products do not fall within the RCRA definition of solid waste and are not subject to regulation as hazardous wastes [(American Mining Congress v. EPA, 824, F. 2D. 1157, DC Circuit 1987)]." The report also is fully correct in noting (p. 3-23) that

processing "wastes" may not satisfy the definition of solid wastes at all of the facilities at which they are generated. In other words, ICF acknowledges that the definition of a waste is facility-specific. Nonetheless, ICF has included anode slags, converter slags, and refinery slimes among the "wastes" produced at domestic copper smelters and refineries. All of these materials are recycled at the Kennecott Utah Copper facility, but, more to the point, there are no active domestic smelter/refinery facilities where these materials are not now recycled.[3] Certainly the PEI Associates report[4] on which this draft RTC is based (in part) claims that these particular materials are recycled, and even Exhibit 3-10 (p. 3-35) and Exhibit 3-11 (p. 3-36) of the draft RTC identify "recycle" as the predominant management practice for these materials.

The same comment may also be generally applicable to ESP, baghouse, and other dusts.

The implication of the foregoing is that the list of "wastes" included in the draft RTC needs to be shortened considerably from the 13 materials considered by ICF.

Second, Kennecott Utah Copper challenges the generation rate data presented in the draft RTC. Shown on Table 2 are ICF's estimates of the material generation rates -- average values and ranges -- for 13 materials. Shown also on Table 2 are corresponding estimates for the Kennecott Utah Copper smelter/refinery complex. While data from

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[3]This has been confirmed either in telephone conversations with personnel from Asarco, Inspiration, Consolidated Copper Company, Phelps Dodge, Magma, and White Pine, or by inspection of their submittals to EPA. Interestingly, Magma is now mining its slag pile, so that material formerly discarded (smelter slag) is now being recycled at this facility. The data presented in the RTC II Technical Memorandum for Copper Sector appears to claim that converter slags are discarded at the Phelps Dodge, Playas, Smelter. In fact, these slags are further processed in an electric slag cleaning furnace (ESCF). Only the residues from the ESCF furnace are discarded.

[4]"Overview Of Solid Waste Generation, Management, and Chemical Characteristics Primary Copper Smelting and Refining Industry," PEI Associates, Inc., Cincinnati, Ohio, prepared for U.S. Environmental Protection Agency, Cincinnati, Ohio, 1984.

TABLE 2
COPPER INDUSTRY "SOLID WASTE" QUANTITIES
CONTRASTED WITH DATA FOR KENNECOTT UTAH COPPER[g]

Material	ICF Estimates[a]		Kennecott Utah Copper Data[b]	
	Average Generation Rate (mt per mt product)	Range of Facility Generation Rates (mt/mt)	Gross Generation Rate (mt per mt product)	Net Generation Rate (mt per mt product)[c]
Process wastewater	0.27	(0.016-0.52)	NA[d]	NA[d]
Furnace brick	**0.0027**	**(0.0017-0.0049)**	**0.007151**	**0.**
ESP, baghouse, and other dusts	**0.484**	**(0.064-1.75)**	**0.036550**	**0.0218[e]**
Chamber solids	**0.11**	**(0.087-0.136)**	**0.074**	**0**
Smelting slag	3.02	(2.40-5.00)	2.61	2.166
Acid plant blowdown	**0.84**	**(0.054-3.706)**	**17.50**	**0[f]**
Bleed electrolyte	0.459	(0.117-0.8)	0.1796	0[f]
WWTP Sludge	**0.543**	**0.543**	**0.3868**	**0.3868**
Anode furnace slag	0.094	(0.022-0.152)	0.04718	0
Contact cooling water	0.015	(0.001-0.026)	NA[d]	NA[d]
Converting slags	**0.605**	**(0.194-0.80)**	**0.140**	**0**
Slimes	**0.002**	**(0.0005-0.0053)**	**0.0055**	**0**
Crud	**0.0044**	**(0.0002-0.015)**	**0**	**0**

[a] Based on waste generation reported in a survey of 1982 industry activity and comments provided by industry.
[b] Based upon Kennecott submittals to EPA.
[c] Includes the effect of recycle.
[d] No estimate produced because EPA definitions were ambiguous or no match could be found.
[e] Will be zero in future.
[f] These streams are treated; treated water is recycled, and only the sludge remains as a waste.
[g] Lines shown in bold are materials for which the reported range does not include Kennecott data on the basis of either net or gross generation rate.

Source: RTC draft report, pp 3-26, 3-27.

any one facility cannot be used to question a reported industry-average value, it is noteworthy that actual data for the Kennecott Utah Copper facility fall outside the range of values reported by ICF, for nearly all the materials identified in the draft RTC. (These are shown in bold on Table 2.) This is true whether the data are compared on a gross or net (considering recycle) basis. These data were submitted by Kennecott Utah Copper (and many other firms in the industry) in response to a request from EPA for corrections, so we can only conclude that these submittals were not considered either by EPA or its contractor, ICF.

Nor are the omissions limited to just the Kennecott Utah Copper facility. Copper Range, for example, has no acid plant, and therefore does not produce any acid plant blowdown, acid plant sludges, or spent catalyst. Yet none of the reported ranges of "generation rates" for these streams in Exhibit 3-6 of the draft RTC include zero. Likewise, the electrolytic refining circuit at this facility does not include an electrolyte bleed,[5] so no bleed is generated at this facility. But the reported range (0.117-0.8) of generation rates for electrolyte bleed in the same exhibit of the draft RTC does not include zero.

For these reasons, Kennecott Utah Copper is forced to conclude that several, possibly all, of the responses to EPA's request for facility-specific information were not considered in the preparation of the draft RTC. Thus, the statement in the draft RTC (p. 3-8) that "the available data on facility-specific waste generation . . . were converted to production-based generation rates," and other statements (e.g., p. 3-2 or 3-29) implying that industry data and/or comments were employed are misleading, to say the

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[5]Letter of Russell L. Wood, President, Copper Range Company, to Ben Haynes, U.S. EPA, 10 June 1987.

least. The smelting and refining industry devoted considerable time and money in responding to EPA's request for authoritative site-specific data. It is unfortunate that ICF chose to ignore the wealth of actual data contained in these submittals. The final report should take these submittals into account to provide Congress with accurate information.

Inclusion of Inappropriate Facilities

Kennecott Utah Copper maintains that some of the facilities included by ICF in its analysis of primary copper smelters and refineries should not have been considered. For example, the Tennessee Chemical Company smelter in Copperhill, Tennessee, closed in 1987, and should not be included. Likewise, the 110,000 mtpy Southwire Company refinery in Carrolton, Georgia, treats secondary materials, and should not be included because wastes from such plants are not excluded by the Bevill Amendment.[6] In a companion document to the draft RTC,[7] ICF acknowledged these errors;

> "Two copper facilities were included in this generally conservative analysis, although their operations may not be affected by EPA's regulatory determination. The Tennessee Chemical Company facility in Copperhill, TN has announced that it will close at the end of 1987 but was included in this analysis because it is presently operating. The Southwire Company facility in Carrolton, GA was also included, although it may process enough scrap and blister to be classified as a secondary copper producer."

The consequences of inappropriately including these facilities are that (i) waste quantities will be overstated, (ii) the statistics on waste management practices at operating primary copper production facilities may be biased, and (iii) the statistics on

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[6]See, e.g., U.S. Bureau of Mines, Minerals Yearbook 1984, pp. 301-302, where the smelter associated with this facility is termed a secondary smelter.

[7]U.S. Environmental Protection Agency, RTC II Technical Memorandum for the Copper Sector, 1987, p. 3.

site characteristics will be distorted -- for example, both of these facilities are in locations with relatively small distances to ground water, a statistic that is accorded some importance in Chapter 5 of the draft RTC.

Too Few Alternatives Considered

Kennecott Utah Copper is concerned that the set of regulatory alternatives considered by ICF in the draft RTC is unduly restrictive. The regulatory alternatives considered in the draft RTC include "Subtitle C," Subtitle C-," and "No Action" (a misnomer, as discussed below). This limited choice fails to consider other viable -- and possibly optimal -- alternatives, such as a "Subtitle D" or "Subtitle D+" regime.

While it would be presumptuous to forecast the outcome of EPA's regulatory determination with respect to smelter and refinery wastes, the way in which the alternatives in the draft RTC are structured and the tone of the discussion invites the "no action" alternative to be dismissed as insufficiently protective of the environment, and the "Subtitle C" alternative rejected as being too restrictive and/or costly. This leaves the reader with the impression that the "Subtitle C-" alternative is the "obvious" middle ground or balanced solution.

Yet even the draft RTC carries the implication that the actual extent of regulatory flexibility associated with a "Subtitle C-" alternative is not entirely clear (p. 2-2, p. 6-13). Legal analysis conducted by Kennecott Utah Copper also points to numerous uncertainties about the extent of EPA's flexibility to modify regulations under Subtitle C (see below).

Thus, the "obvious" regulatory choice identified in the draft RTC is ambiguously defined. For this reason, ICF can offer little assurance that the estimated costs of a "Subtitle C-" alternative are anywhere near those given in the draft RTC.

Moreover, the omission of a "Subtitle D" or "Subtitle D+" alternative is a particularly egregious error. Given EPA's decision to regulate mining wastes within the Subtitle D regulatory framework, it would be eminently rational to place smelter and refinery materials management under the same regulatory umbrella. This argument applies with particular force at integrated facilities (see above). Finally, failure to consider a Subtitle D+ alternative is inconsistent with EPA's own mine waste management plan.

The draft RTC notes (p. 6-4) that,

> "...the alternatives for regulation of processing wastes are likely to be further expanded by the RCRA Subtitle D regulatory program that is currently under development by EPA. At this time, however, development of the mining waste program is in its formative stages, making inclusion in this analysis impractical. There are, therefore, many possibilities for waste management that could result from EPA's future regulatory determination." (See also p. 6-2.)

Although this statement implies that EPA will consider other Subtitle D alternatives, these are not developed in the draft RTC -- supposedly a key input to the regulatory decision process. If EPA plans to consider other alternatives this should be stated and the alternatives identified in the draft RTC.

As a point to be noted in passing, Kennecott Utah Copper takes issue with the choice of words in the rubric "no action." Although the draft RTC states clearly (p. 6-4) that "the baseline, or 'no action,' regulatory scenario assumes that existing regulations and practices will not be changed as a result of the findings of this report to Congress and EPA's subsequent regulatory determination," it also notes (p. 6-7), "Even with such a regulatory determination, however, some changes in waste management practices may be required. . ." One of the reasons for this caveat is that (p. 6-8) "proposed requirements have not yet been defined." In short, "no action" may be a misnomer in view of what

might (some would say "is likely to") occur under Subtitle D. As noted below, even the present regulatory regime cannot be termed a "no action" scenario.

The draft RTC also notes (p. 6-4) that "the alternatives for regulation of processing wastes are likely to be further expanded by the RCRA Subtitle D regulatory program for mining waste that is currently under development by EPA." If so, why not explicitly consider Subtitle D or D+ alternatives for regulation of smelting and refining wastes? If indeed these regulatory alternatives are so obviously open-ended that they cannot be anticipated (as is alleged in the draft RTC), there is little question as to the flexibility of a Subtitle D program. Whereas, in contrast, there is a great deal of uncertainly over the flexibility inherent in Subtitle C- regulation. In view of the numerous places in the draft RTC where ICF refers to key site-specific differences at smelting and refining operations (e.g., what is or is not a waste, all of the risk-mitigating factors identified in Chapter 5 of the draft RTC, as noted in Section II), it is clear that inflexibility (or even potential inflexibility) in establishing regulations is neither in EPA's interests nor those of the regulated community. This inflexibility is elaborated in a later subsection.

Inadequate Discussion of Applicable Federal and State Regulations

As noted above, RCRA Sections 8002(f) and (p) require EPA to prepare a "detailed and comprehensive" Report to Congress on mineral processing wastes, including analysis of applicable laws and regulations. Chapter 4 of the draft report prepared by ICF, Inc., attempts to respond to this Congressional directive, but is neither an adequate response nor a useful aid in determining whether additional regulation of processing wastes is warranted.

Although the ICF draft considers several scenarios for Subtitle C regulation of processing wastes, it does not provide an adequate description of the requirements that

such regulation would impose. The draft's discussion of currently applicable laws and regulations omits important federal authorities and describes other inaccurately. The discussion of current state regulatory programs is even more cursory. Nor does the draft discuss EPA's legal obligations under RCRA Section 1006 and Executive Order 12612 to avoid duplication of existing Federal requirements and defer to State regulation when possible.

The cumulative effect of these deficiencies is a draft report creating the impression that there are substantial gaps in current regulation of processing wastes, and that Subtitle C regulation would pose only minimal compliance problems for existing facilities. However, the effects of Subtitle C regulation cannot be determined unless all Subtitle C requirements are considered, and the impression that current regulation may be incomplete is inaccurate -- at least with respect to Kennecott Utah Copper facilities. Table 3 lists eight existing State or Federal laws that may be applied to the company's facilities for managing smelting and refining wastes identified as potentially hazardous in the ICF draft report. Some of these wastes also will be subject to the subtitle D mining waste regulations that EPA currently is developing. The existing laws listed in Table 3, and regulations promulgated pursuant to them, subject Kennecott Utah Copper facilities to a full panoply of regulation governing air emissions, discharges to surface and ground water, and reclamation of surface resources. As demonstrated in Table 4, under these existing authorities the company's facilities may be subjected to all of the major types of regulatory requirements that were imposed under EPA's Subtitle C regulations prior to the 1984 RCRA Amendments.

The regulation depicted in Tables 3 and 4 is significantly different and more comprehensive than the incomplete and disjointed picture of existing regulatory requirements presented in the draft report prepared by ICF. If the final report is to be

TABLE 3.
EXISTING STATE AND FEDERAL LAWS APPLICABLE TO KENNECOTT UTAH COPPER SMELTER AND REFINERY WASTES

Federal Solid Waste Disposal

Utah Solid and Hazardous Waste Act

Federal Clean Water Act

Utah Water Pollution Control Act

Federal Clean Air Act

Utah Clean Air Act

Utah Mined Land Reclamation Act

Federal Comprehensive Environmental Response, Compensation and Liability Act

TABLE 4.
EXISTING REGULATORY REQUIREMENTS APPLICABLE
TO KENNECOTT UTAH COPPER SMELTER AND REFINERY WASTES[1]

Statutory Authority	Permitting	Emergencies	Records/ Reports	Safety/ Administration	Ground water Monitoring	Ground water Control	Corrective Action	Surface Water Control	Air Emissions Control	Closure/ Post Closure	Financial Responsibility
Federal Solid Waste		X	X	X	X	X	X	X	X	X	
State Solid Waste	X		X	X	X	X	X	X		X	X
Federal Air	X		X						X		
State Air	X		X						X		
Federal Water	X		X					X			
State Water	X	X	X	X	X	X	X	X			
State Mining	X		X	X		X	X	X	X	X	X
CERCLA		X	X		X	X	X	X	X	X	X

[1]For purposes of comparison, the listed regulatory requirements were taken from the current Federal Subtitle C regulations. This table is not meant to suggest that current requirements are exactly the same as those imposed under Subtitle C, but only that existing laws impose requirements comparable to those contained in the Subtitle C regulations.

[2]Mining and mineral processing wastes currently are exempt from the Utah hazardous waste regulations, but the state statute permits the State Solid and Hazardous Waste Committee to subject these wastes to hazardous waste regulations, if necessary.

truly "detailed and comprehensive," as RCRA Section 8002 requires, the discussion of applicable laws and regulations in the ICF draft must undergo substantial revision. An attachment to this document describes the various requirements that currently apply to Kennecott Utah Copper facilities and presents suggestions for improving the relevant sections of the ICF draft.

Unwarranted Assumptions of "Subtitle C-" Regulatory Flexibility

In discussing the "Subtitle C-" regulatory scenario, the draft RTC assumes that EPA has sufficient legal authority to craft reasonable Subtitle C regulations for processing wastes (pp. 6-12-13). This assumption is dramatically at odds with EPA's findings on this issue in the mining waste regulatory determination:

> "While under existing law, EPA would have some flexibility to modify its standards for hazardous waste management as applied to these wastes, there are substantial questions about whether the flexibility inherent in the statute coupled with EPA's current data on these wastes provide a sufficient basis for EPA to develop a mining waste program under subtitle C that addresses the risks presented by mining wastes while remaining sensitive to the unique practical demands of mining operations."[8]

The discussion in the draft RTC relies entirely on RCRA Section 3004(x) as authority to establish a reasonable "C-" regime. However, EPA's brief in the current litigation over the mining waste determination notes substantial uncertainties in both the type of requirements that can be modified under Section 3004(x) and the permissible bases for such modification:

> "The modification authority of Section 3004(x) of RCRA is circumscribed and guided by the requirements specified in the section. There is at least some doubt about the propriety of using Section 3004(x) as authority for waiving any requirements other than those listed in that section. In addition . . . this

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[8] 51 Fed. Reg. 24496 (July 3, 1986).

provision does not provide clear unambiguous authority to take cost into account in tailoring subtitle C requirements for mining waste. The Agency rationally concluded that Section 3004(x) might not provide authority to waive subtitle C requirements on purely economic grounds. In light of the Agency's concerns about possible closures of mining facilities, this ambiquity posed a significant limitation."[9]

According to EPA, the agency's authority to modify Subtitle C requirements not covered by Section 3004(x) is even more uncertain. This is also clearly stated in EPA's brief in the mining waste litigation:

"EPA also has general authority under Section 3004(a) of RCRA to modify subtitle C requirements that are not explicitly imposed by the Act . . . There is an important distinction, however, between Section 3004(a) and Section 3004(x) modification authorities. While Section 3004(x) explicitly allows the Agency to consider the "practical difficulties" associated with implementation of the requirements listed in Section 3004(x), Section 3004(a) does not have a parallel provision. Therefore, the role of economic considerations is even more ambiguous under Section 3004(a) than it is under Section 3004(x)."

Hence, EPA has admitted that it may lack authority under Section 3004(x) to modify on economic grounds the three Subtitle C requirements that would be modified under the draft RTC's "C-" scenario: land disposal restrictions, minimum technology and corrective action requirements. The agency has found that authority for such modification of other Subtitle C requirements, such as administrative standards, financial assurances, lining and capping requirements and the "mixture" and "derived-from" rules, is even less certain. Nor is it clear that EPA currently has sufficient data to modify these requirements on grounds other than cost. The absence of such data was a major consideration in EPA's regulatory determination for mining waste.[10] As demonstrated in other sections of these comments, this concern applies with at least equal force to the processing wastes addressed in the draft RTC.

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[9]Brief for Respondents at 31-32, EDF v. EPA, D.C. Cir. No. 86-1528 (filed November 24, 1987) (citations and footnotes omitted).

[10]See 51 Fed. Reg. 24500 (July 3, 1986).

The draft RTC seems to imply that the need for modification of Subtitle C requirements is not as great for processing wastes as for mining wastes. This is certainly not true at Kennecott Utah Copper's integrated facility. Kennecott Utah Copper's operations generate 410,400 tons per year of slag tailings, which are placed on the company's 5600-acre tailings pond. Treatment of refinery bleed electrolyte and smelter acid plant blowdown water produces 73,492 tons of WWTP sludge per year, and on-site accumulation of this sludge is substantial. Kennecott Utah Copper is currently investigating methods of treating this sludge and disposing it in the most environmentally sound manner. The company's WWTP produces millions of gallons of treated water per year, which is discharged to the tailings pond and recirculated through the concentrators. At Kennecott Utah Copper's operation, mining and processing wastes are managed in the same integrated system, and Subtitle C regulation of processing wastes would cause the same problems that EPA previously identified for mining wastes. The final RTC should clearly state the effects of Subtitle C regulation on such integrated operations and the agency's perceived limitations on its ability to modify Subtitle C requirements.

Omission of Many Key Regulatory Issues

It is Kennecott Utah Copper's view that many key regulatory issues are not explicitly addressed in the draft RTC. As noted above, perhaps chief among these omissions is the failure of the draft RTC to come to grips explicitly with the so-called "derived from" or "mixture" rules contained in Subtitle C of RCRA. As noted by Evans Kitchel and Jenckes[11] in comments prepared in behalf of Phelps Dodge Corporation,

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[11] Letter of J. Stanton Curry, Esq., Evans, Kitchel and Jenckes, to Ben Haynes, U.S. EPA, 11 June 1987, p.5.

"The 'derived from rule' states that '(a)ny solid waste generated from the treatment, storage, or disposal of a (listed) hazardous waste, including any sludge, spill residue, ash, emission control dust, or leachate ... is a hazardous waste,' unless it is delisted by petition. See 40 C.F.R. section 261.3(c)(2)(i), 261.3(d)(2). The 'mixture rule' states that if a listed hazardous waste is mixed with any solid waste, the entire waste mixture is deemed to be a hazardous waste. See 40 C.F.R. section 261.3(a)(2)(iv).

All it takes to trigger the chain reaction of these provisions is the designation of a primary smelting or refining mine waste as a listed hazardous waste. Any residue or material derived from the reclamation of such a listed hazardous waste and any mixture of such a listed hazardous waste with any other waste material (such as mine tailings) would be subject to hazardous waste regulations. Furthermore, any on-site treatment (including reclamation), storage, or disposal of the listed waste, waste residue, or waste mixture would subject the facility to full Subtitle C regulation as a TSD permitted facility. Regulation as a TSD facility would subject all solid waste disposal units to 'corrective action' under RCRA section 3004(u), which probably will be equivalent to RCRA Subtitle C regulation. Since on-site treatment or recycling would not change the regulatory status of the waste or facility under Subtitle C due to these program-expanding provisions, there would be little incentive for the development of environmentally sound technologies for the on-site treatment or recycling of such listed mine waste."

An important concern of companies engaged in smelting and refining is that these two provisions would virtually ensure that all materials (whether wastes or secondary materials) would become "hazardous" regardless of their actual characteristics if the "derived from" or "mixture" rules were in place.

To restate an earlier example, suppose that APB were to become a listed waste under Subtitle C.[12] The technique of placing APB on a tailings pond, practiced at some locations, such as the San Manuel facility, would effectively be banned (notwithstanding whether or not this could be shown to be environmentally sound) -- a conjecture apparently shared by ICF (p. 6-12 of draft RTC). But, depending upon whether or not EPA chooses to challenge the recent court ruling (AMC vs. EPA op. cit.), so too would be the practice of treating the APB and circulating the purified water to a tailings pond for

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[12]This supposition is not fanciful. EPA has indicated that APB is a potential candidate for listing on several occasions, such as in the original mine waste report.

eventual recycle to the benefication process. (This would also apply if the sludge were treated to render it inert.) EPA has explicitly stated[13] that with respect to listed wastes in a Subtitle C context, "residues derived from reclaiming listed by-products and sludges would also be considered to be listed for purposes of this regulation." Water reclaimed from a Waste Water Treatment Plant (WWTP) would presumably be listed under these circumstances. Now it is Kennecott Utah Copper's contention that such material would be a process stream rather than a solid waste -- a position sustained by the above-referenced court decision. Nonetheless, the possibility of a successful appeal and the recent different EPA interpretation[14] of this court decision renders a final regulatory determination far from certain. Needless to say, such an outcome would be catastrophic from Kennecott Utah Copper's perspective -- at the Kennecott Utah Copper facility the ratio of APB to refined copper output is 17.5 to 1! Even if reclaimed/recycled water from the WWTP -- although "listed" -- were excluded from immediate consideration on the grounds that it was not a solid waste, such an exclusion might terminate at such time as the facility was closed.

The suggestion that process material would be treated as a waste upon termination of operations at a facility has been made by EPA. In EPA's mine waste management plan, the following comments are most explicit with respect to leaching operations,[15]

> "Approximately one-sixth of the wastes resulted from dump/heap leaching processes. (Dump or heap leaching involves the placement of water, acid, or cyanide-containing solutions onto sometimes enormous piles of material. The liquid percolates through the pile and dissolves valuable

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[13] In the preamble to the 4 January 1985 regulations redefining solid waste (50 Fed. Reg. 619).

[14] 53 Fed. Reg. 519.

[15] U.S. EPA Management of Mining Wastes, RCRA Subtitle D Regulatory Program Development, Detailed Management Plan, Office of Solid Waste, 22 June 1987, p. 4-9.

metals, including copper, gold, and/or silver. The 'pregnant liquor,' by then containing dissolved metals, then is collected at the base of the pile and the metals are recovered.) It should be noted that under RCRA, the pile, the liquid, and the liquor are not considered to be wastes while the leaching process is in operation. However, any liquid or liquor that escapes the process (e.g., liquor that escapes through the base of the pile rather than being collected) is a waste. When leaching operations end and the site is abandoned, any remaining liquid and liquor, and the pile itself, also become wastes." (Emphasis Added)

By analogy with the above, if WWTP effluent were regarded as a waste upon cessation of operations at a facility where treated water from the WWTP were placed on the tailings pond for use in the mill and if APB were listed and the "derived from" and "mixture" provisions of Subtitle C were operative, we are concerned that EPA would claim that the entire tailings pond (5,600 acres in Kennecott Utah Copper's case) would need to be treated as a hazardous waste!

EPA may argue, of course, that these concerns are groundless, and that such Draconian solutions are not intended. If so, EPA should complete the legal analysis to justify this contention. Moreover, such analysis should be presented in the final RTC. No explicit discussion of the "mixture" or "derived from" rules can be found anywhere in the draft RTC, let alone EPA's perception of how they might apply to site-specific materials management. Without an explicit discussion of these key points it is impossible to evaluate any of the cost analysis or conclusions reached in the draft RTC.

EP Toxicity Test Results Misleading

ICF used EP toxicity test results to determine that several materials should be considered hazardous; process wastewater, smelter slag, acid plant blowdown, bleed electrolyte, and WWTP sludge. As noted above, the data base contains too few samples to ensure the statistical validity of ICF's conclusions. For example, if smelter slag production is regarded as a batch process (as is certainly true for converter slag production), the lower one-sided 95% confidence interval on the fraction of batches that

might be regarded as hazardous based upon the 2 in 11 test results (p. 3-30) would be 0.033,[16] or slightly more than 3 batches out of 100! (The proportion could also be higher, but the point here is that test results from only 11 samples are not precise.) This computation assumes that the EP test is valid and that "false positives" do not occur -- both points of contention.

Apart from problems associated with small sample sizes, the legitimacy of the EP toxicity test itself is doubtful. EPA has received numerous and detailed critiques of both the EP and successor TCLP tests[17] Table 5, for example, recapitulates portions of the executive summary of one submittal. Although EPA is fully aware of the shortcomings of the EP toxicity test -- to the extent of including this as a study issue in the management plan for the study of mine wastes (issue 4, p. 4-22) -- the draft RTC uses this test to determine waste characteristics -- a key input to this document.

In sum, this portion of the report is significantly in error. The EP toxicity test results are not a useful predictor of the hazardous character of mining/smelting/refining wastes as actually managed and, even if they were, the sample sizes are too small to draw meaningful conclusions.

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[16]See, e.g., National Bureau of Standards, Experimental Statistics, Handbook 91, 1963, p. T-41.

[17]"Final Report, Technical Evaluation of the USEPA Extraction Procedure," October 15, 1984, prepared for the Lead Industries Association & Cadmium Council by American Resources Corporation, Valley Forge, PA 19482, and Environmental Engineering & Management, Minneapolis, MN 55435. Letter to EPA RCRA Docket (S-212), from John Knebel, President, American Mining Congress, Washington, D.C., dated 25 June 1987, subject: Docket No. F-87-TCN-FFFFF, Supplemental Notice of Proposed Rulemaking -- Hazardous Waste Management System; Identification and Listing of Hazardous Waste (52 FR 18563, May 18, 1987). Letter to EPA RCRA Docket (S-212), from John D. Yoder, Director, Environmental Health, Lead Industries Association, Inc., New York, N.Y., dated 13 August 1987, subject: Docket #F-8-7-TCN-FFFFF. Technical Brief, "Evaluation of the Extraction and Toxicity Characteristics Leaching Procedures," RP2485-8, Electric Power Research Institute, Palo Alto, CA 94303. Letter to EPA RCRA Docket, from Connie Glover, Lancy Environmental Services, Zelienople, PA 16063, dated 17 September 1986, subject: Docket #F-86-TC-FFFF.

TABLE 5.
CONCLUSIONS REGARDING THE SUITABILITY OF THE EP TOXICITY TEST

1. Considerable scientific controversy exists over the potential for misidentification (i.e., to identify a hazardous waste as nonhazardous, or vice versa) by the U.S. EPA's extraction procedure.
2. The EP focuses on a co-disposal scenario and does not take into account segregated disposal of wastes (a monofill scenario).
3. The EPA's documentation of the sampling and sample preservation methodology to be used with the EP does not specifically address waste properties and test conditions -- such as particle size, liquid to solid ratio, chemical composition of liquid and solid components, sample age and curing effects -- that are known to affect leachate quality. Poor sampling and preservation techniques may contribute significantly to sample-to-sample variation and result in misclassification of a waste's hazard.
4. The EP's sample preparation steps for monolithic wastes focus on the physical condition of the waste prior to extraction and have the potential to introduce sample-to-sample and lab-to-lab variation. The procedure allows for the same sample to be extracted in any form from a single piece to a finely ground powder. Properties such as particle size and surface area have been shown to affect leachate quality; test results on samples which are altered from their original physical state may be non-representative of field results or of those expected from the EPA scenario of codisposal.
5. The EP requires an initial liquid-solid separation if there is free liquid present in the waste sample. Subsequently, the liquid is combined with the extract produced from the solid. These two steps allow for the potential of significant sample-to-sample variability; depending on the relative concentration and volume of the waste liquid and the extract, one may dilute the other. The variability may be compounded by the lack of sampling procedures or guidelines which specifically address liquid to solid ratio as a sample property of concern. The representativeness of these procedural steps to field conditions is also questioned.
6. Several other procedural steps utilized in the EP can bias the results or cause test variability. These include the type of agitator used (several are specifically approved and others may be allowed), the wide temperature range allowed during extraction (20 to 40,C, or 68 to 104,F), and the pH adjustment procedure (alternate modes are allowed).
7. pH adjustment is the primary means used in the EP to simulate sanitary landfill leaching conditions. The EP's reliance on pH adjustment to simulate sanitary landfill leaching makes it probable that wastes are incorrectly identified as hazardous or nonhazardous. Depending on the particular metal species, pH adjustments may either increase or decrease its solubility. Additionally, other factors such as the presence of complexing agents in leachate, the oxidation-reduction potential maintained by the leachate, and the ionic activity of leachate can be significant in leaching. The EP has no specific procedures designed to simulate these factors within ranges typical of sanitary landfills. The EP utilizes a higher acetic acid concentration (0.5M) than the concentration recommended (0.3M) by their researchers.
8. Interlaboratory evaluation programs found the EP to have poor overall precision. The reported poor precision of the extraction procedures remains one of the major concerns relative to the use of the procedure for classification of wastes. High variances obtained in several carefully controlled interlaboratory programs suggest that a large number of interlaboratory samples would need to be obtained and analyzed, in many cases, to statistically determine whether or not a given waste should be considered hazardous.

Source: "Final Report, Technical Evaluation of the USEPA Extraction Procedure," October 15, 1984, p. 2-3, prepared for the Lead Industries Association & Cadmium Council by American Resources Corporation, Valley Forge, PA 19482, and Environmental Engineering & Management, Minneapolis, MN 55435.

Unfortunately, this flaw in the draft RTC cannot be eliminated merely by rewriting. Additional data gathering and analysis are also required.

Damage Cases of Limited Relevance For Decision-Making

In response to the Congressional mandate (Section 8002 (p)(4) of RCRA) to analyze "documented cases in which danger to human health or the environment has been proved," ICF has selected a data base consisting principally of a number of CERCLA (SARA) sites for further study. Although ICF acknowledges in passing (p. 5-34) that "the danger presented at these sites may not be due entirely to mismanagement of solid waste generated" and "documented examples of danger that has resulted from a waste disposal practice may reflect conditions that no longer exist," these important qualifications are lost in the extensive site discussion that follows.

In fact, most of the sites considered in ICF's analysis began operations in the latter part of the last century (e.g., in 1884 at Anaconda, 1899 in Palmerton, 1890 in Cherokee County, Kansas, 1885 in Milltown, 1888 at East Helena, 1879 at Smuggler Mountain), or early part of this century. Whatever environmental damages may have occurred reflect operating practices over nearly a century.

For example, the Anaconda smelter was one of the few copper smelters in the world configured to treat "dirty cons," i.e., concentrates containing high arsenic levels.[18] This smelter had closed by the time EPA addressed arsenic emissions to the air at copper smelters. Sulfur capture rates at the Anaconda copper smelter at no time exceeded 38%[19] versus an average of 90% for present-day smelters. (Untreated emissions contain

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[18]This was made necessary because of the uniquely high arsenic content of the Montana ores.

[19]"The International Competitiveness of the U.S. Non-Ferrous Smelting Industry and the

arsenic as well as SO_2.) Moreover, the smelter was closed in 1980 largely because ARCO decided that the cost of installation of additional environmental controls was prohibitive. Kennecott Utah Copper does not claim that environmental damages have not occurred over the nearly one hundred years of operation of this smelter. But this case cannot be used to prove that present technology and operating policies lead to environmental damage.

As a second example, the Eagle mine is included (p. 5-38) as a case study site. Table 6 presents a brief chronology of mining and CERCLA activities at this site. Nowhere does it show the construction and operation of a smelting facility that even approximates present practice. The "roaster" is the only item of equipment that could be termed a processing facility, even with a much-stretched definition. Moreover, this plant closed in 1919, nearly 70 years ago! Certainly this cannot be termed a relevant precedent.

As a third example, notwithstanding the assertion in the Smuggler Mountain Record of Decision (ROD)[20] that a smelter was once located at this site, there is no reliable evidence that either smelting or refining ever took place there. According to mine records, ores from the mines in this site were smelted either at the Holden smelter at Castle Creek or at Leadville, Colorado, and not at the NPL site.[21] Claims that there was a smelter on the site apparently rest on a misinterpretation of old site photographs. According to Stefan Albouy of Smuggler Consolidated Mining Company, smokestacks visible in these photographs are associated with boilers for steam pumps used for

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[20]U.S. Environmental Protection Agency, Region VIII, Record of Decision, Smuggler Mountain (September 1986).

[21]Personal communication, Stefan Albouy, Smuggler Consolidated Mining Company, (303-925-2049).

TABLE 6.
CHRONOLOGY OF MINING AND SUPERFUND ACTIVITIES
RELEVANT TO THE EAGLE MINE SITE

1878	Prospectors identify oxidized silver-lead and oxidized gold-silver ore in Red Cliff-Gilman area.
1880	Belden, Black Iron, Little Chief, Horn Silver, and Wyoming Valley mines established in area. The Battle Mountain Smelter was constructed and began operations.
1881	Construction of narrow-guage railroad line to Leadville, Colorado, leads to closure of Battle Mountain Smelter as shipment to more efficient smelters in Leadville becomes viable.
1884-1894	Mining of gold/silver/lead ores continues, but mine workings exhaust oxidized zone ores and extend to zinc-containing sulfide zones. These ores unsuitable for treatment by Colorado smelters, and area goes into decline.
1905	Mining of zinc deposits begins with the construction of a roasting and magnetic separation plant near town of Belden (near Gilman) by the Pittsburgh Gold and Zinc Company and successor companies, Eagle Mining and Milling Company and New Jersey Zinc. Waste from this facility forms what are termed "roaster piles" at the Superfund site.
1912-1916	Empire Zinc Company, a subsidiary of the New Jersey Zinc Company begins to acquire and consolidate properties, including the Eagle Mine.
1919	Belden roaster halts operation; ore sent to Canon City for milling and further processing.
1929	Construction of underground 600-tpd froth-flotation mill completed. Mill wastes sent to old tailings pond.
1931	Zinc production halts as prices slide.
1932-1940	Production continues from copper-silver ore bodies.
1941	Zinc production resumes spurred by demand-led price recovery. Between 1942 and 1946, the ore is shipped offsite for milling.
1946	Onsite milling resumes with construction of new tailings area and elevated wooden pipeline.
1946-1950	Major mill modifications.
1966	New Jersey Zinc merged into Gulf.
1977	New Jersey Zinc closes zinc mining and milling operations at Eagle Mine.

TABLE 6.
CHRONOLOGY OF MINING AND SUPERFUND ACTIVITIES
RELEVANT TO THE EAGLE MINE SITE
(continued)

1977-1979	Reclamation activities conducted, movement of tailings, revegetation 1979 experiments, etc.
1983	Eagle Mine facility sold to Glen Miller on 1 September. Miller conveys 1,400 acres to Battle Mountain Corporation. Facility operated to extract copper-silver ore. State of Colorado files CERCLA Section 107 Natural Resources Damage Claim.
1984	Miller gradually abandons mine. Electrical power costs paid by Gulf to prevent flooding while electrical equipment removed to surface; removal action taken to relocate PCB-containing equipment; site proposed for NPL in October, State given lead role.
1985	State of Colorado-sponsored RI/FS is completed by Engineering-Science, Inc.
1986	Proposed ROD issued by State of Colorado in February; parallel and critical RI/FS completed on behalf of gulf by Dames and Moore, dated 24 March 1986; revised ROD issued by State of Colorado on 8 April 1986; Eagle Mine placed on NPL in June 1986; negotiations continue between State of Colorado and Gulf.

Sources: Engineering-Science, Inc., Preliminary Assessment Report, Eagle Mine Feasibility Study, prepared for State of Colorado, Dept. of Law, 2 December 1985.

Engineering-Science, Inc., Detailed Analysis Report, Eagle Mine Feasibility Study, prepared for State of Colorado, Dept. of Law, 20 December 1985.

Engineering-Science, Inc., Eagle Mine Remedial Investigation Draft, prepared for State of Colorado, Dept. of Law, 21 November 1985.

Dames & Moore, Comments & Objections of Gulf & Western Industries, Inc., to Proposed State Record of Decision, 24 March 1986.

State of Colorado, Office of Attorney General, Final Record of Decision for Eagle Mine Facility, 8 April 1986.

Personal communication, Barry Levene, EPA, Region VIII, Denver, Colorado.

dewatering of the Mollie Gibson (and possibly other) mine(s) rather than a smelting operation. Laura Clemmens,[22] EPA Region VIII's current project officer for the site notes that EPA only suspects that some smelting took place at the site many years ago, and admits that EPA lacks "concrete information" to prove this assertion. Given the facts as presented, it is difficult to justify inclusion of this site in a study of damages from smelter and refinery wastes.

The draft RTC (pp. 5-33, 5-34) claims that the cases used for analysis had to satisfy four logical constraints:

> ". . . Next, each case was reviewed to determine if it met the following four conditions:
>
> (1) Measured or estimated above-background concentrations or doses of processing waste constituents must be equal to or greater than their respective reference concentrations or doses;
>
> (2) Human or environmental receptors must be exposed or have likely future exposure (e.g., by drilling water supply wells into contaminated ground water);
>
> (3) Danger must be clearly from primary metal processing wastes and not just other types of waste (e.g., mining); and
>
> (4) Production processes used at the facility must be comparable to current practices inasmuch as the wastes produced are similar.
>
> All cases in which each of these four conditions were met were considered danger cases."

Kennecott Utah Copper believes that the Anaconda site does not meet criterion 4 in the above list, and that the Eagle and Smuggler Mountain sites do not satisfy criteria 3 or 4.

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[22]Personal communication, Laura Clemmens, EPA Region VIII, (303) 293-1518.

Economic Analysis Not Done and Cost Analyses Not Verifiable

Section 8002(f) of RCRA mandates an analysis of "alternatives to current disposal practices . . . the costs of such alternatives and the impact of these alternatives on the use of . . . natural resources." As Kennecott Utah Copper interprets this mandate, the study should address both the incremental costs and resulting economic impacts of possible RCRA regulation. This is because economic impacts of alternative waste management practices are clearly relevant to "the use of natural resources."

With respect to these Congressional mandates, the draft RTC is disappointing. First, because (as noted above) the regulatory scenarios have sufficiently uncertain implications to make the cost estimates of doubtful relevance. Kennecott Utah Copper requests the details of the cost analysis be made available so that the reasonableness of that analysis can be gauged. And, second, because the report fails to address the economic impacts that would result from any resulting cost increases. Economic impacts include facilities closures and layoffs, price and balance of trade impacts, competitiveness shifts, changes in domestic self-sufficiency, etc. -- none of which are addressed in the draft RTC. Without this information it is not possible to draw meaningful conclusions about the wisdom of regulatory alternatives.

Kennecott Utah Copper recognizes that such an economic analysis is a substantial undertaking, but absent this information, the RTC cannot be termed responsive to the Congressional mandate.

Potential Danger Analysis Results Misleading and Otherwise Flawed

Finally, Kennecott Utah Copper avers that the analyses of potential danger presented in Chapter 5 of the draft RTC are incomplete, misleading, and significantly flawed, an opinion apparently shared by EPA's own Science Advisory Board (SAB),[23] in its review of a similar ICF analysis of mining wastes.

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[23] Hazardous Waste News, Vol. 9, #43, 2 November 1987, p. 417.

Kennecott Utah Copper challenges both the cases chosen for analysis and the associated risk calculations for reasons similar to earlier comments on the proposed risk analysis of mining waste (see attached). At the very outset of Chapter 5, the toxicity of waste leachate is analyzed. This analysis is flawed by its reliance on the EP toxicity test.

It should be noted in passing that EPA is reportedly in the process of revising arsenic risk estimates downward,[24] by a factor of 100, based upon a reexamination of the health effects data and the policy decision to lower risks associated with easily treatable and rarely fatal forms of cancer. If this information is correct, then the arsenic toxicity estimates in the draft RTC should likewise be lowered.

Significantly, when some factors affecting exposure are taken into account (pp. 5-13 et seq.), the toxic constituents are diluted to arguably de minimis levels (see p. 5-27 et seq.). Even these calculations cannot be claimed to be realistic. The effective dilution factors are based upon ICF's flawed mine waste risk analysis. Moreover, this dilution scenario still omits other important risk-reduction factors even if the basic exposure scenario is deemed credible and attention is focused only on a maximally exposed individual. These calculations do not consider the effects of treatment of certain of these streams. For example, Kennecott Utah Copper treats acid plant blowdown and other material streams in a WWTP. This treatment plant effects an 85% to 99+% reduction in the metals concentration of the influent, as shown in Table 7. Moreover, even this WWTP effluent is mixed with other process waters and rain water in the tailings pond. Thus, actual risks are likely to be orders-of-magnitude smaller than calculated by ICF. Finally, the analysis presented in the draft RTC takes no cognizance

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[24] Inside EPA, 25 Dec. 1987, pp. 14-15, and Shabecoff, P., "EPA Reassesses the Cancer Risks of Many Chemicals," The New York Times, 4 Jan. 1988, pp. 1 et seq.

TABLE 7.
WASTEWATER TREATMENT PLANT
INFLUENT AND EFFLUENT METALS ANALYSIS
(mg/liter)

Date	Copper		Lead		Zinc		Manganese		Nickel		Arsenic		Selenium	
	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff	Inf	Eff
2/83	31.6	.28	7.8	.44	3.0	.02			12.1	.56	58.2	5.5	1.5	1.07
3/83	33.8	.31	13.7	.63	15.3	.02			12.8	.26	75.8	4.4	3.0	1.13
4/83	30.9	.35	26.3	1.62	9.4	0.05			11.4	.48	73.7	1.3	1.7	.82
5/83	46.9	.26	33.4	.74	10.7	.05			19.1	2.03	104.2	2.4	3.3	1.70
7/83	70.3	.29	12.9	2.51	18.1	.03			33.1	.21	217.5	9.9	1.9	.17
8/83	79.8	.31	16.9	1.69	18.5	.02			34.5	.08	181.8	1.2	8.1	1.91
9/83	44.4	.17	19.7	2.61	25.5	.04			14.7	.11	122.8	4.2	2.4	.23
10/83	53.6	.19	12.0	3.83	36.4	.04			25.0	.10	190.5	5.3	3.6	.21
3/84	34.3	.16	14.1	.84	14.6	.10	.31	.03	5.3	.54	131.6	6.2	3.0	.14
4/84	21.3	.07	14.5	.74	10.7	.10	.34	.03	6.9	.13	104.8	2.9	7.1	.19
5/84	33.9	.66	12.9	1.98	12.4	.29	.53	.03	5.11	.19	95.6	4.2	6.8	.17
6/84	68.2	.39	14.1	2.10	29.5	.18	.33	.02	3.8	.15	161.0	9.0	5.1	.17
Weighted Average	45.8	.28	16.5	1.66	17.0	.08	.38	.03	15.5	.40	126.7	4.7	4.0	.66
Removal Efficiency	99.4%		89.9%		99.5%		92.1%		97.4%		96.3%		83.5%	

of the extensive set of existing regulations, summarized in Table 4 and detailed in one of the attachments. At Kennecott Utah Copper operations -- and we assume at other locations -- existing regulations impose stringent requirements that serve to invalidate the assumptions of the potential risk analysis.

Even using their conservative assumptions, ICF found that (p. 5-26), "using the maximum dilution factors, none of the waste streams are expected to pose a hazard to human receptor populations." Even assuming their minimum dilution factors, more than half of the toxic constituents pose no problems. Thus, it is quite likely that a realistic, site-specific analysis would show little or no hazard. Nevertheless, ICF concludes (p. 7-4):

> "Accounting for potential dilution of constituents when released to groundwater, all the wastes except all wastes in the lead sector and smelting slag wastes in the copper sector still contain at least one constituent at potentially hazardous levels."

The conclusions should be revised to accurately reflect the body of the analysis.

The state-of-the-art of risk analysis is evolving, and many government officials and others are shifting away from reliance upon such unrealistically conservative assumptions in risk calculation -- a topic explored below.

Kennecott Utah Copper has not prepared alternative risk analyses, but stands willing to provide constructive input to EPA. Absent credible site-specific analyses, this section of ICF's report should be used only to screen out cases where there is clearly no danger, not as an indication of risk.

Conservatism Challenged: Evolving Perceptions and Executive Orders Nos. 12291 and 12498

As noted above, there is a growing awareness in the regulatory community that,

(i) conservative assumptions can significantly overstate risks,

(ii) such overstatement is ultimately counterproductive, and

(iii) more realistic risk estimates are appropriate.

Table 8 presents a selection of pointed observations from regulatory personnel, environmentalists, and academics that address uncertainty, conservatism, and the consequences to risk and exposure assessment.

As indicated by these quotes, current thinking appears to be shifting away from the "better-safe-than-sorry" premise toward the development of models and selection of assumptions that more accurately portray the actual risks. The place for conservatism (if at all) should be in the risk management rather than the risk analysis phase of regulatory action -- a distinction missed entirely by the authors of the draft RTC. Raiffa,[25] Chairman of the Committee on Risk and Decision Making, National Research Council, offered the following suggestion:

> "Probabilistic reports should not prejudice policy issues and purposely report with a prudent bias. Cascading prudent reports could result in imprudent actions, and there is a danger of double-counting competing risks. Such reporting should be honest, and not attempt to second-guess policy choices.
>
> Probabilistic reports about diverse consequences to health, for example, are very often slanted to be conservative. I believe that it is better to report honestly, and that prudence should, more appropriately, be accounted for in the evaluation process, rather than in the assessment process." (Emphasis added)

Barnard[26] echoed these comments in an essay on the partnership between law and science in risk analysis/management,

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[25]Raiffa, H. (1982). "Science and Policy: Their Separation and Integration in Risk Analysis," in The Risk Analysis Controversy: An Institutional Perspective, H. C. Kunreuther and E. V. Ley, eds., pp. 32-33, Springer-Verlag, Berlin/Heidelberg/New York.

[26]Barnard, Robert C., "Science, Policy, and the Law: A Developing Partnership in Reducing the Risk of Cancer," Reducing the Carcinogenic Risks in Industry, Marcel Dekker, Inc., New York and Basel.

TABLE 8.
UNCERTAINTY, CONSERVATISM, AND RESULTING CONSEQUENCES IN RISK ANALYSIS

QUOTE	REFERENCE
"Historically at EPA it has been thought prudent to make what have been called conservative assumptions; that is, our values lead us, in a situation of unavoidable uncertainty, to couch our conclusions in terms of a plausible upper bound. This means that when we generate a number that expresses the potency of some substance in causing disease, we can state that it is unlikely that the risk projected is any greater. This is fine when the risks projected are vanishingly small; it's always nice to hear that some chemical is not a national crisis. But when the risks estimated through such assessments are substantial, so that some action may be in the offing, the stacking of conservative assumptions one on top of another, becomes a problem for the policymaker. If I am going to propose controls that may have serious economic and social effects, I need to have some idea how much confidence should be placed in the estimates of risk that prompted those controls. I need to know how likely real damage is to occur in the uncontrolled, partially controlled, and fully controlled cases. Only then can I apply the balancing judgments that are the essence of my job." (Emphasis added.)	Ruckelshaus, W. D. (former EPA Administrator), "Risk in a Free Society," Risk Analysis, Vol. 4, #3, 1984, pp. 157 et seq.
"I'm skeptical of quantitative risk assessment, at least in the cancer field. The science is too imperfect, and the results are likely to be used literally, because all the caveats get lost." . . . "Milton Russell, Assistant Administrator for Policy, Planning, and Evaluation at EPA, added that 'depending on which animal you use, and whether you use a model that uses surface area or weight, you can get a difference in risk of up to 39,000 times.' He went on to add that uncertainties in the risk assessment process are multiplied (not added) and in the case of cancer risk this leads to extreme conservatism in the decision-making process. 'If you are relatively sure of the probability of risk, like automobile accidents, the range of uncertainty is narrow, and the difference between a plausible upper bound and a maximum likelihood and a plausible lower bound is relatively small. But if you are quite uncertain (as we are in many of these health effects), the range between this upper and lower bound is very, very large. Multiplying the large uncertainties associated with each factor in the estimate leads to cascading conservatism in decision making." (Emphasis added.)	Ahmed, K. (Research Director for the Natural Resources Defense Council), as quoted by B. Barker, "Cancer and the Problems of Risk Assessment," EPRI Journal, December 1984, p. 30. Barker, B., "Cancer and the Problems of Risk Assessment," EPRI Journal, December 1984, p. 30.

TABLE 8.
UNCERTAINTY, CONSERVATISM, AND RESULTING CONSEQUENCES IN RISK ANALYSIS
(continued)

QUOTE	REFERENCE
"Often each conservative assumption is made by a different scientist or analyst responsible for a portion of the risk assessment. Each may think that erring on the side of caution or conservatism is reasonable. However, the effect of these individual conservative assumptions is compounded in the final estimate of risk presented to the decisionmaker. For example, if at each of two different steps in an analysis, estimates are chosen that have a 5 percent chance of being less than the true risk, then the final risk estimate will have only a 0.25 percent chance of being less than the true risk (0.05 x 0.05 = 0.0025). That is, the risk estimate will have a 99.75 percent chance of being greater than the true risk. If there were 5 steps in the analysis instead of 2 and a conservative estimate at the 5 percent level were chosen for each step, then the final risk estimate would have a 0.00003 percent (0.05^5) chance of being less than the true risk, or 3 chances in 10 million. In other words, the estimate has a 99.99997 percent chance of overstating the true risk. In practice, there may be as many as 20 distinct stages in a risk assessment where conservative assumptions are made. A typical risk assessment would probably contain about 10. The final risk estimate derived from these compounded conservative assumptions may be more than a million times greater than the best estimate and may, thus, have a probability of being accurate that is virtually zero. Some combinations of these highly cautious assumptions so overstate the risk that they are unrealistic."	Executive Office of the President, Office of Management and Budget, Regulatory Program of the United States Government. April 1, 1986 - March 31, 1987, Washington, D.C., pp. xxv, et sec. Note: This discussion is simplified in several respects. Important aspects such as the independence/correlation among inputs and how these combine in the final risk equation have not been addressed fully. Nonetheless, the basic phenomenon identified here is accurate.
. . . "More recently, EPA has adopted the multi-stage model which has a linear component at low doses (4). This model assumes that cancer is caused by a series of mutational steps, whose occurrence rest both on dose and potency. This model also results in a conservative estimate. Most scientists accept these models as giving plausible upper limit estimates for a chemical's potency at low levels of exposure. In other words, the potency of a substance is unlikely to be higher that (sic) estimated using the linear model, but could be substantially lower. Use of the linear non-threshold models reflects EPA's decision to err on the side of caution in the face of uncertainties. The final result of the linearized extrapolation is a 'unit-risk factor,' which gives the estimated upper limit lifetime risk per unit of exposure." (Emphasis added.)	Patrick, D. R. (EPA), "Environmental Protection Agency's Risk Management Policy," Environmental Progress, Vol. 4, #1, February 1985, pp. 20-22.

TABLE 8.
UNCERTAINTY, CONSERVATISM, AND RESULTING CONSEQUENCES IN RISK ANALYSIS
(continued)

QUOTE	REFERENCE
"These gaps in our scientific understanding and data limitations imply that it is difficult to conduct a good risk assessment. It is no surprise that they vary in quality. The many stages where judgment must be applied make it very easy for the results to substantially overestimate or underestimate the unknown true risks. Because a government agency's mandate typically is to protect the public, or to be safe rather than sorry, the cumulative effect of these conservative assumptions may be very large. The resulting risk estimates often are treated as plausible upper bounds. Unless the uncertainty associated with each assumption is stated, risk managers often view these risk estimates as actual risks." (Emphasis added.)	Fisher, A. (EPA), "Using Risk Assessments in Policy Decisions," draft EPA document, 1986, p. 13-14.
"The Agency is not alone in its concern that different assumptions and different mathematical models used can significantly alter the outcome of risk assessment. When the Occupational Safety and Health Administration (OSHA) published its cancer policy in 1980, it did detailed comparisons of how estimates of carcinogenic risk can vary with the assumptions used in developing the estimates (45 FR 5198-5200). By varying the method of low dose extrapolation used, and the toxicology or epidemiology study which formed the basis of the risk assessment commenters to the OSHA policy developed risk estimates for exposure to 1 ppm of vinyl chloride which ranged from 10^{-8} (one in one hundred million) to 10^{-1} (one in ten, or 10%). A similar exercise with saccharin by NAS, and reprinted in the OSHA policy (45 FR 5200), estimated the expected number of cancer cases in the general population (exposed at 0.12 grams/day) at between 0.001 cases per million exposed, and 5200 cases per million exposed. These differing estimates were developed by using different low-dose extrapolation models and different animal-to-human extrapolation methods -- all of which had some credence in the scientific community."	United States Environmental Protection Agency, Risk Assessment: Framework for Decision Making, EPA 600/9-85-002, December 1984, p. 16.
"Probabilistic reports should not prejudice policy issues and purposely report with a prudent bias. Cascading prudent reports could result in imprudent actions, and there is a danger of double-counting competing risks. Such reporting should be honest, and not attempt to second-guess policy choices. Probabilistic reports about diverse consequences to health, for example, are very often slanted to be conservative. I believe that it is better to report honestly, and that prudence should, more appropriately, be accounted for in the evaluation process, rather than in the assessment process." (Emphasis added.)	Raiffa, H., "Science and Policy: Their Separation and Integration in Risk Analysis," The Risk Analysis Controversy: An Institutional Perspective, Springer-Verlag, Berlin, Heidelberg, New York, H. C. Kunreuther and E. V. Ley, editors, 1982, pp. 32-33.

TABLE 8.
UNCERTAINTY, CONSERVATISM, AND RESULTING CONSEQUENCES IN RISK ANALYSIS
(continued)

QUOTE	REFERENCE
"Recent research has also shown a need to reevaluate the role of 'conservatism' in assessing and managing risk. Making a 'conservative decision' (i.e., one that is likely to be more protective of health and the environment than an alternative decision) is widely accepted as a prudent practice in risk management. In keeping with the recommended separation of risk assessment and risk management activities, however, conservative assumptions, conservative models, conservative estimates, etc., should not be key elements in the science-based risk estimation steps. A catenation of conservative assumptions, models, and estimates throughout a risk assessment can lead to a 'worst-case' (or even worst-of-the-worst-cases) prediction that may be of little value (or possibly misleading) to the decision maker. Most decisions actually involve 'either-or' choices between technological alternatives with different risk levels rather than a 'yes-no' choice on a single risk. When dissimilar alternatives require different analysis procedures, conservatism ambiguously or inconsistently applied could lead to biased results and poor decisions -- even to the choice of a technology that is less protective of human health and the environment and possibly more costly to society than an available alternative. Best estimates of the risks, costs, and benefits for the alternatives, coupled with consideration of their uncertainties (including worst-credible case considerations), should produce the optimal basis for decision making. The Council on Environmental Quality has recently noted that 'rules of reason' should replace worst case analysis as the basis of regulatory decision making (CEQ, 1985, 1986). (Emphasis added)	Midwest Research Institute, Risk Assessment Methodology For Hazardous Waste Management, Draft Final Report, prepared for EPA under Contract No. EQ4C15, 31 July 1986.

"It is sometimes said that the scientific evaluation of risk should be 'conservative' because it deals with human health. But this puts 'conservatism' in the wrong place in the regulatory structure. It is the function of the regulator to apply the social criteria of cost, safety, reasonableness, and acceptability. It is in making these decisions that 'conservatism' may play a role. If a scientific evaluation is constrained in the name of 'conservatism' by social values or management policy, the result will be biased in unobvious ways. Such an evaluation does not provide a sound basis for the difficult social/legal decisions a regulator must make."

Many of the above ideas (including those given in Table 8) are addressed (explicitly or implicitly) in Presidential Executive Order No. 12291 (February 17, 1981) and No. 12498 (January 4, 1985) directed broadly at regulatory reform. Executive Order 12291 requires benefit/cost analysis of major Federal regulations. Executive Order 12498 reaffirmed these guidelines and explicitly addressed health and safety matters directly, stating,[27] "Regulations that seek to reduce health or safety risks should be based upon scientific risk assessment procedures, and should address risks that are real and significant rather than hypothetical or remote". (Emphasis added). Such language is pointedly directed towards increasing the realism of risk analysis and is particularly relevant in the context of this draft RTC. Indeed, "improving coordination and consistency in risk reduction" was one of the principal themes in the recent Executive Office of the President, Office of Management and Budget (OMB) 1986-1987 Regulatory Program. In particular, this document defines the regulatory agenda for implementation of the above referenced Executive Orders. Improvements to risk assessments was a major topic of this report. OMB was strongly critical of the conservative assumptions often employed in carcinogen risk and exposure assessment and highlighted the reasons why such practices were problematic,[28]

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[27]Executive Office of the President, Office of Management and Budget, Regulatory Program of the United States Government, April 1, 1986 - March 31, 1987, Washington, D.C., 1986.

[28]Executive Office of the President, Office of Management and Budget, Regulatory Program of the United States Government, April 1, 1986 - March 31, 1987, Washington, D.C., 1986.

"Risk Assessments with such extreme conservative biases do not provide decisionmakers with the information they need to formulate an efficient and cost-effective regulatory strategy. Furthermore, the inconsistency of these assumptions makes it virtually impossible to compare risks from different sources. It is particularly difficult to compare safety risk estimates, which are usually best estimates, with health risk estimates, which usually are not best estimates, because the latter embody a series of conservative assumptions. Even different estimates of health risks may not be comparable because of the different degrees of conservatism built into them. Where risk estimates for two different risks cannot be compared, it will be impossible to compare the effects of regulations controlling them.

A perverse and unfortunate outcome of using upper-bound estimates based on compounded conservative assumptions is that it may lead us to regulate insignificant risks and ignore more serious risks. Furthermore, the more uncertain we are about the risk posed by a particular hazard, the higher the upper-bound risk estimate will be. Therefore, the less information we have on the risk posed by a potential hazard, the more likely we are to regulate it. Other hazards that pose certain but smaller risks are not considered as dangerous and may not be regulated. Yet, hazards with better understood risks may be more serious.

All the problems we have discussed resulting from compounding conservative assumptions can be addressed by developing best estimates at each stage of the risk assessment process. Estimates of the uncertainty and the outer ranges of potential risk can be developed to supplement the best estimate. Both the best estimate and these supplementary risk indicators should be made available to decisionmakers. Then, if regulatory decisionmakers want to choose a very cautious strategy of risk control, they could do so and a margin of safety could be applied at the final decision and would be based on all the available information about its consequences and those of alternative strategies. The public and affected parties would also benefit from knowing both the expected risk and the margin of safety rather than being given only alarming and inconsistent estimates that are likely to be very different from actual risks.

Only when best estimates of risks and other information on the likely level of risks are presented to the decisionmaker, rather than hidden in the assumptions, can we be sure that we are issuing regulations that will make society as well off as possible. Fortunately, more review by regulating departments and agencies and by the Executive Branch has already begun to improve consistency in risk assessment and risk management and, thereby, improve societal welfare. Executive Order No. 12291 provides a mechanism to help ensure consistency." (Emphasis added.)

The above quotation -- and extended discussion from which it was extracted -- underscores the desirability of and executive branch emphasis upon the need for realism in risk analysis. The philosophy and assumptions of the ICF risk analysis are completely at variance with the above.

Miscellaneous Errors

Space constraints do not permit an exhaustive enumeration of the many technical errors in the draft RTC. Individually, these may not be critical (e.g., many of the site-specific data sheets, the use of a generic model to describe a small but heterogenous population of facilities, numerical errors), but collectively they call to question the accuracy and thoroughness of the study effort on which the draft RTC is based. Kennecott and, we believe, other firms in the industry are willing to prepare further corrections if EPA so wishes.